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| Deep-learning approach to the iron concentration evaluation in silicon solar cell |
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| **Abstract:** | The abstract should be preparedvia Times New Roman (Font) and 10 pts, single spaced with 2 cm margins on all sides and align full. The length of Abstract should be between150 and 200 words. The abstract should be informative by referring study aims, the methodology, the instruments, the major findings and the implications of the study. |
| ***Keywords****:* | *silicon solar cell, iron concentration,* *neural network, ideality factor* |

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Impurities are crucial for solar cell (SC) performance. Various methods are proposed to estimate impurity concentration, but special equipment or sample preparations is required for their application. The aim of our work is to show the possibility of fast and easy evaluation of impurity iron concentration using current-voltage characteristics (CVC) measuring. For this purpose, SCAPS was used to simulate the IVCs for n+-p-p+-Si structures with various both base thickness (150-240 μm) and boron doping level (1015 ÷ 1017 cm-3) in range 290-340 K.

. The recombination was considered to be associated with iron atoms (with concentration range 1010 ÷ 1013 cm-3) and two following cases were under investigation: i) the coexistence of interstitial atoms Fei and pairs FeiBs (equilibrium state, *n*Fe-FeB); ii) the presence of Fei only (excited state, *n*Fe).

Simultaneously the fast and common way to SC characterize is measuring of current-voltage characteristics (IVC). An ideality factor (n) can be easy determined from IVC. The aim of our work is to show the possibility of fast and easy evaluation of impurity iron concentration using n value.

Two following cases of iron (1010 ÷ 1013 cm-3) related recombination were under investigation: i) the coexistence of interstitial atoms Fei and pairs FeiBs (equilibrium state, *n*Fe-FeB); ii) the presence of Fei only (excited state, *n*Fe). *n* values and SC parameters for more than 10,000 structures were used for *neural* *network learning.* API Keras was used to construct the *network with up to 4 hidden dense layers and iron concentration as* output*.* It has been shown that mean squared relative error for test data prediction was up to 0.28 in case of network, which trained by *n*Fe-FeB value and up to 0.06 in case of both *n*Fe-FeB and *n*Fe using.

*(up to 300* neuron in each, relu activation*)*